DOCUMENT RESUME

ED 059 612 EM 009 609

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TITLE	Statement Before Select Subcommittee on Education.
INSTITUTION	Educational Products Information Exchange Inst., New York, N.Y.
PUB DATE	1 May 71
NOTE	48p.; Paper presented to the Select Subcommittee on Education
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	Educational Technology; *Evaluation Needs; *Instructional Materials; Instructional Media; *Instructional Technology; Program Evaluation; Publishing Industry; *Summative Evaluation; Textbook Evaluation

ABSTRACT

Unless educational technology is focused on the improvement of learning, it becomes simply a means of making education seem more efficient without being truly effective. Improved materials are urgently needed because of growing demand for individualized learning and teacher accountability. Schools now are forced to use inadequately verified material because that is all that is available. It is estimated that 99 percent of the materials school children now use have not been put through even the initial phases of the learner-verification and revision cycle. This happens partly because schools select material without demanding information about such verification. It is probable that the material currently produced could be revised to meet the learner-verification criteria with only minor changes. There is an urgent need for a set of realistic guidelines to help product developers institute a program of verification and revision and for a set of guidelines to assist schools in selecting instructional material. (Author/JY)

ED 059612

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Statement of P. Kenneth Komoski

President of the Educational Products Information Exchange Institute

Before

Select Subcommittee on Education

Committee on Education and Labor

United States House of Representatives

May 11, 1971

INTRODUCTION

Mr. Chairman, my name is Kenneth Komoski. I am President of the Educational Products Information Exchnage Institute. The Institute, usually referred to as EPIE (pronounced "eppy"), was chartered in 1967 by the Regents of the State University of New York as a nonprofit corporation. It is a consumers' union for member schools and school systems in 50 states. With support from these schools, other members, and foundation grants, the Institute conducts independent studies of all types of educational materials and equipment. It publishes it findings in nine Educational Product Reports each year. At present, these reports reach about 3,500 educators in schools, colleges, and other institutions.

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Prior to organizing EPIE, I served as co-director of the Institute for Educational Technology at Columbia University. While in that position, I edited the first publication to document the fact that many educational materials which schools assumed had been developed through a process of field testing and revision - a process which EPIE has labeled "learner verification" - had, in fact, never been tried out and revised on the basis of feedback from learners prior to publication.

Before joining the University, I directed a non-profit research and development organization which had pioneered in the creation of learn-verified educational materials. I have also been a classroom teacher, the head of a junior high school, and a special consultant on educational technology to UNESCO and to the U.S. State Department.

During the past year, I have served as an advisor to the Rand Corporation's Study for the National Institute of Education and as the chairman of the forum on Educational Technology at the 1970 White House Conference on Children.

My research efforts in educational technology have focused primarily on improving student learning by improving the effectiveness of the materials from which students are expected to learn.

I believe that

POINT 1.1

Educational technology: effectiveness then efficiency

unless educational technology is focused first and foremost on the improvement of learning, it becomes simply a means of making education seem more efficient without being truly effective. Once the difficult goal of effectiveness is being consistently achieved, education can easily be made more efficient. To proceed in any other fashion means leaving the ultimate educational consumer - the learner - in a constantly vulnerable position.

One important function of the proposed National Institute of Education must be to conduct research and provide leadership that will guarantee all American citizens that every educational material from which children are required to learn is as effective as we know how to make it.

What I have to say to you this morning will clearly indicate that there is an enormous need for better educational materials, and an even

greater need for procedures that will guarantee their continuous improvement. The proposed National Institute could provide many of the means and methods upon which that improvement depends.

THE PRESENT SITUATION - WHAT SCHOOLS USE AND WHY

POINT 2.1

50 Million children are unprotected from inadequately developed educational materials

My review of the present situation regarding the development, selection and, use of educational materials has led me to the following conclusion: At this time of national concern over consumer protection, the largest single group of unprotected consumers is made up of the 50 million school children who are being required to learn from educational materials almost all of which have been inadequately developed and evaluated.

The materials I refer to are the textbooks, films, tapes, kits, and complex multimedia systems that are the concrete artifacts of learning in our schools. These materials are the tools of learning, constantly used and depended upon by teachers and students alike. Indeed, one can conceive of a school without walls, or even an educational system without schools, but a modern educational system without tools--in the form of a variety of educational materials--is inconceivable. Today's education requires that these tools be better, sharper, more dependable--in other words, more effective -- than ever before.

POINT 2.2

Improved materials are urgently needed because of growing demands for: individualized learning; greater teacher account-ability

This requirement is urgent. The interaction of two growing trends in education demand it. The first is the trend toward more independent, individualized learning on the part of students. The second is the demand for greater accountability on the part of teachers. As these two trends continue to build, the need for materials of demonstrated dependability and effectiveness will become more and more acute. If materials with these qualities are not generally available, neither students nor teachers can be expected to meet the new demands being made on them.

We are only now beginning to comprehend the need for learner-oriented, individualized educational materials. For decades educators have talked about the fact that learning is an individual act and that each learner must ultimately have an individualized program. Today there is growing evidence that this talk is finally being translated into action. But those educators who are acting - by establishing new types of individualized learning environments - are beginning to realize that the quality of the materials they put into the hands of learners is a critical factor in the success of their new programs. When, in addition, these educators are likely to be held more rigorously accountable for the learning of each individual student, they are going to pay even more attention to the quality

and appropriateness of the materials being made available to them. However, if higher quality materials are not generally available neither teachers nor their students can be expected to be held completely accountable for learning failures.

POINT 2.3

Schools use inadequate materials because they must use something

But the overwhelming majority of the materials now used by schools are not of "the highest possible quality." Thus, to answer the questions the Committee has put to me as succinctly as possible:

"What do schools use?" -- They use what's available.

"Why?" -- Because it's available, and you can't run a school without materials.

During the last two decades, new technologies, new media, and Federal money made possible enormous and continuing increases both in the production and purchasing of these traditional group-oriented educational materials. This is not to say that Federal money hasn't also helped to develop a small number of new, more effective, learning materials. It has. But for every Federal dollar spent since 1958 on the development of new, more effective materials, hundreds more have also been made available to schools for the purchase of materials that are

much less effective than they should be.

POINT 3.1

Modern technology is producing an increasing quantity of trivial options- but teachers and students need high quality <u>alternatives</u> to these inadequate materials

The result is that educational purchasers are being presented with a tremendous variety of options -- even more than are offered to the American car buyer. But, as is the case with so many of those automotive options, the educator's options are too often trivial variations on over-worked and, in the long run, ineffective themes. Today's teachers and students do not need an ever-increasing quantity of options. What they do need desperately are <u>high quality alternatives</u> to the inadequately developed materials they are now required to use.

Before I turn to this crucial question of quality, I want to take a few minutes to examine in some detail the quantitive growth of educational materials during the last two decades. My examination begins at a point seven years before NDEA began to prime the materials-purchasing pump with Federal dollars. In 1951, the <u>American Educational Catalog</u> -- the only source that attempted a comprehensive catalog of materials developed for use in elementary and secondary schools -- listed some 5,600 items. Although some workbooks and films were included, almost all the items were standard textbooks with standard formats, designed

for use in the standard (30 student) American classroom by the "average" teacher teaching "average" students. Other less comprehensive catalogs may have contained additional listings of perhaps five to eight thousand items, mostly films,many of which had not been produced primarily for use in schools. But a safe estimate of strictly school-focused materials would be in the neighborhood of 10,000 items.

Twenty years later, the 1971 El-Hi Textbooks in Print, the successor to the American Educational Catalog, lists about 14,000 textbooks. The publisher, R.R. Bowker, estimates that the catalog also refers to 56,000 workbooks and other supplementary materials marketed along with those textbooks. The increase appears to be ten-fold

Bowker has also published separate catalogs, compiled at the University of Southern California, of films, filmstrips, and transparencies.

These catalogs list some 55,000 additional items, only a few of which are included as nonbook supplementary materials in Textbooks in Print. Taken together, the mateials listed in all Bowker Catalogs total 126,000.

But that is not all. During the last year, Westinghouse Learning Corporation has published a seven-volume catalogue called Learning Directory, which covers all media, and lists 207,000 items. And even this ambitious effort inevitably falls short of presenting a full picture of the materials available to schools. Every such "comprehensive" catalog is obsolete the moment it is printed: its potential content is constantly growing both in number of items and in kinds of media.

For instance, the information you are now looking at is being projected from a film transparency via an overhead projector. In 1951, there were no overhead transparencies for use in schools. Today, a USC-Bowker catalog lists approximately 13,000 sets of transparencies. The Westinghouse Directory lists 15,000 sets and EPIE estimates that there are

actually over 20,000 sets commercially available for school use. EPIE's estimate exceeds both the Westinghouse and USC-Bowker listing largely because neither managed to identify all commercial producers of transparencies; indeed, EPIE is not certain that it has identified all of them. Furthermore, this estimate of 20,000 does not include the hundreds of thousands of transparencies that are produced by the schools themselves. And transparencies are just one of the many kinds of media which have been introduced into the schools since 1951.

In 1951, 16 mm film had just begun to be used widely in schools. Other uses of film, Super 8 film loops, 35 mm sound filmstrips, and EVR (Electronic Video Recording, actually film) had not yet appeared. Likewise, school use of audio tapes was some years off, and video tapes had not even been invented. The use of programmed instruction books and teaching machines was a decade away; and computer-assisted instruction (CAI) a bit further. Simulation games were even further in the future; and today's most "in" materials--multimedia instructional systems--were unheard of.

Today, twenty years later, schools have available to them at least 50,000 instructional film materials-- 16 mm films, 8 mm films and loops, and 35 mm filmstrips.

There are upwards of 20,000 audio tapes which schools may purchase or rent. Thousands more are being produced and used locally by schools themselves.

Although a recent survey by National Instructional Television indicates that approximately 85 percent of the instructional television being broadcast to schools is provided by only 223 video tapes, an estimated additional 10,000 one-inch, 1/2 inch and 1/4 inch video tapes, produced both commercially and locally, account for hundreds of thousands of nonbroadcast hours of television instruction.

In the ten years since they were introduced programmed instruction materials for school use have increased from a few dozen to approximately 4,000, approximately five hundred of which must be used in specific types of teaching machines. All of these programs could be adapted to CAI, and many have been.

Simulation games for education are still in their infancy. However, there are now 404 catalogued for school use, and the publisher of the catalog estimates that twice that number are nearing completion.

Multimedia kits are perhaps the most difficult instructional materials to quantify with any reliability. Many of them are sold as parts of instructional programs based on textbook series; others are sold to stand alone. Some are made up simply of a book and audio tapes, while others contain a great variety of assorted materials and equipment. Thus, it is impossible to arrive at an exact count, but they clearly number in the thousands.

POINT 3.2

There are at present well over 200,000 education materials being marketed to schools

Overall, the growth in all types of materials since 1951 may be described conservatively as an increase of about twenty-fold; from something over 10,000 in 1951 to well over 200,000 in 1971.

As I have mentioned, much of this growth was made possible by advances in production technology, the appearance of new media -- and increased purchasing

power with Federal funds. But there have been other factors, as well, ones which have contributed to the quantity of materials but which primarily are related to the question of quality. They have brought about materials of greater social relevence and materials with new teaching approaches and/or more valid and up-to-date content. Unfortunately, the factors have only indirectly contributed to the improvement of the learning effectiveness of the materials they have introduced.

The first of these additional factors, social relevancy, has been responsible for the introduction of new subjects into the curriculum. Thus we now have materials in "Black Studies", in "Sex Education", in "Environmental Education" or "Ecology". And who in 1951 would have predicted that today third-grade pupils in elegant Public School #6 in New York City would be using instructional materials on the dangers of narcotics?

The second of these factors has been the appearance of new approaches to teaching and learning e.g., learning by discovery, by simulation, or, as is the case with the Initial Teaching Alphabet, a new orthography. All of these approaches have been quickly supported by new instructional materials, including many which have completely restructured traditional subject matter, so that we now have the "new math", "Project English", and the "new social studies", to mention a few.

POINT 3.3

New methods of developing educational materials

An important handful of these new departures -- funded by Federal or private foundation support -- have also managed to help pioneer new methods of developing educational materials.

"Biology", for example, has been a high school course since the nineteenth century. In 1951, it had been essentially unchanged since that time. Basically, it was a course in taxonomy, and the most widely used standard textbook available was Holt's Modern Biology, essentially a compendium of taxonomic information, designed for use in the traditional teacher-dependent, "average" class of

of 30 "average" students. A decade ago, the Federally-supported Biological Sciences Curriculum Study Group began work on a new biology course. But because the group of prominent educators and biologists assembled did not agree that all students could best learn biology from a single approach with a single textbook, their work produced three separate approaches to the learning of biology: a "cellular" approach, a "biochemical" approach and an "ecological" approach.

POINT 3.4

Learner-verification and revision a major new departure in product development

In addition to these new departures, the developers also took a new approach to the development of their materials: they thoroughly evaluated the effectiveness of their materials on a group of learners and revised them accordingly, before they were released for commercial distribution. This process of learner verification and revision emerged about a decade ago, primarily in the development of programmed instruction materials. Since that time the process has been adopted by many Federally-funded product development programs, but by very few commericial producers.

One reason why commercial producers have not adopted the verification process may be that few schools look for evidence of learner-verification when selecting curriculum materials. This would explain, at least in part, why--ten years later --the non-verified Modern Biology still holds on to a significant portion

of the school market. Another reason is that new materials with new approaches are harder to sell. They often (as is the case with the BSCS materials) require a certain amount of teacher retraining, while the traditional text is as easy for teachers to slip into as an old shoe.

As Edward Katzenbach, former President of Raytheon Education has put it, "The money is in the old stuff, not the new stuff."

PRESENT STATUS OF THE EDUCATION INDUSTRY

POINT 4.1

Small size of the industry and small size of school expenditures for materials

Last year's total sales for all educational companies marketing book and nonbook media (but not including equipment) were no more than $600 million, whereas, 185 single companies in Fortune Magazine's list of the country's top 500 had sales exceeding $600 million. This $600 million represents less than 2 percent of the country's school budget. Or, put another way, local schools are spending less than 2¢ of every budget dollar on the tools of learning. Interestingly, during recent years the average school system has received just about 2% of its budget through Federal support - A major reason why the fortunes of the educational industry have been so closely tied to the availability of Federal money for local schools.

The fact of the matter is, however, that when compared to other important American industries, relatively speaking the "real money" is just not in education, at least not at present. Today, the educational materials industry is small when compared to most others.

Nevertheless, futurists and economists predict that

the educational industry will grow into a major American industry in the years ahead. Assuming they are correct, now is the time, while the industry is still in its economic infancy- and schools are still spending relatively little on its products- to encourage it, cajole it, give it guidance, and, if necessary, to manage Federal support in such a way that money is available to help develop and purchase products of proven worth.

Everything that <u>can</u> be done <u>must</u> be done to get the education industry to fulfill its potential; not by providing the schools with endless -- but in the end trivial -- options, but by supplying effective alternatives for individual learners. The potential impact of its products is enormous. These products contain materials that introduce (or fail to introduce) skills, concepts, facts, and understanding into the minds of 50 million young Americans for twelve crucially important years. No industry in the country produces products of greater importance or potential.

As the late Robert Locke, who, as Executive Vice-President of the McGraw-Hill Book Company, was one of the most forward looking leaders in the education industry, wrote in a recently published Saturday Review article titled, "Has the Education Industry Lost Its Nerve?":

> "The most encouraging sign is that educational research is finally beginning to lead instead of follow educational experimentation.
>
> "The education companies vary greatly in their research and development abilities, but in general it can be said that few of them have any capacity at all to do basic research in education, a function that can best be undertaken in the universities and in organizations devoted solely or largely to research. On the other hand...industry clearly has the capacity to apply research findings to experimental product development."

POINT 4.2

Industry's capacity to apply research findings

Mr. Locke concluded by saying

> "In fact, the chief contribution of industry may come through its ability to apply the findings of research to the development of products and services for education."

POINT 4.3

Present lack on the part of industry

I am in total agreement with Mr. Locke concerning the education industry's capacity to apply the results of research findings to product development, but my analysis of the current status of product development within leading education companies indicates that the industry is a long way from doing so. The research findings to which Mr. Locke referred clearly indicate that the learning effectiveness of a product can best be improved through the process I have referred to as learner-verification and revision.

These terms are simply a researcher's way of saying that the learning effectiveness of a product will be improved if it is taken through a systematic cycle of tryouts with learners followed by revisions based on the feedback. Such evaluations need not always involve large groups of learners. Through appropriate sampling a small group of "target" students can give the product developers ample opportunity to catch errors and trouble spots and to revise accordingly.

As you can see, the learner-verification and revision process sounds like a common-sense approach to development which producers might have discovered for themselves long ago. Indeed, it has been in use in the development of standardized tests for several decades and, as Mr. Locke pointed out elsewhere in his article, the researchers who developed programmed instruction a decade ago were the first to apply it to the creation of learning materials. However,

four years of research by the EPIE Institute into almost every class of materials from textbooks and films to multimedia kits have convinced us that although this research-generated process is becoming more generally understood by educational producers, their capacity to apply it remains, in fact, virtually unutilized.

POINT 4.4

99 percent of present materials are inadequately developed

As a result we estimate that 99 percent of the materials school children are now required to use have not been put through even the initial phases of the learner-verification and revision cycle. If this statistic is disturbing, the picture in particular product areas is even more so. For instance, our investigation in the area of textbooks indicates that under one percent of the approximately 14,000 textbooks being sold to schools has been systematically shaped through the learner tryout and revision process.

Our study included an analysis of the best selling texts-plus-media-supplements in major elementary-high school curriculum areas. This "best seller" list eventually grew to some sixty different texts and their related materials. Fewer than 10 percent of these had even been field-tested prior to publication! I say "even" because the field testing of textbooks is rarely synonomous with learner-verification and revision.In some cases, for instance,

reactions from salesmen in the field are referred to as "field testing". But when "field testing" refers to actual tests of the materials with students, it is done usually just prior to publication with no chance of using the results to improve the product. Such testing is done in the hope of impressing purchasers that the materials in question have actually been used in schools. Thus it is important not to confuse traditional field testing of textbooks with the learner-verification and revision process.

Extrapolating from these sixty "best sellers" to all 14,000 textbooks we may estimate that ten percent or 1,400 of these have been "field tested", in some fashion, but the percentage that have been through learner-verification and revision is minuscule.

In the educational film field, the amount of field testing and/or learner-verification and revision is even less. In the area of broadcast video taped instruction, where EPIE has drawn upon the research of the National Center for Instructional Television, we discovered that only

reactions from salesmen in the field are referred to as "field testing". But when "field testing" refers to actual tests of the materials with students, it is done usually just prior to publication with no chance of using the results to improve the product. Such testing is done in the hope of impressing purchasers that the materials in question have actually been used in schools. Thus it is important not to confuse traditional field testing of text-books with the learner-verification and revision process.

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three of the 223 materials used in over 85 percent of broadcast instructional television have been learner-tested. In other words, only a little over one percent of the television material used in schools has been learner-verified.

The director of the National Center for Audio Tapes at the University of Colorado told EPIE that, while he had no statistical data, it is his opinion that practically none of the estimated 20,000 tapes now available has gone through the verification-revision process.

By far the most discouraging area we have investigated is that of programed instruction. As Mr. Locke and others have pointed out, research in programed instruction did much to develop and refine the process of learner-verification and revision. One would, therefore, expect to find that all (or at least the great majority) of such materials would have been thoroughly tested. Such is not the case. EPIE's examination of 633 of the programed items now in use in major curriculum areas in schools revealed that research evidence was available for only 7 percent of these materials, while some "field testing"

was claimed for another 8 percent. A cursory examination of the remaining 3,000 programs less central to the school curriculum indicates that even a smaller percentage of those seem to have been learner-verified.

Recently, EPIE surveyed a sampling of major educational producers -- some of whom produce programed materials and all of whom have begun to move in the direction of "systems of materials" involving a multitude of media and methods. We got in touch with them in order to ascertain their present attitude toward field testing, learner-verification and product evaluation.

Here is a sampling of their comments as reported by our telephone interviewer:

POINT 4.5

Interviews with producers indicate lack of attention to testing of materials

(Company A, Vice President and Editor-in-Chief)

"A couple of years ago, we wanted to do some field testing, but scheduling wouldn't allow it...It takes too much time and we wouldn't have gotten the books out...It wasn't a question of money, but just scheduling. We're now working on a program we plan to field-test. I hope we can...Testing has lots of problems, you know....

(This company has no information on field testing available to schools)

(Company B, Editor-in-Chief)

"We don't do any real testing from the standpoint of content or pedagogy... When I was Editor-in-Chief at _____, we did a lot of testing..., but we were testing the format, you might say...We found that some difficult-to-produce stuff wasn't necessary... This is the kind of testing most publishers do; it can lead to some improvements from the teaching standpoint, but that's just serendipity."

"More testing is needed, but it costs a lot.. When I was teaching, I always wanted to know about classroom trials, but I never got any information." He concluded with:

"Publishers usually claim materials have been 'classroom tested' or 'u with thousands of students throughout the country', but no one should call what they do 'testing'."

(This company has no information on field-testing available to schools)

(Company C, Senior Vice President, Editorial)

"We have about one hundred and sixty salesmen and consultants who report back what they pick up in the field; that's really our field testing."

[He then described some testing of the company's reading program]..."It involved only about twenty-five or thirty kids, but you know if you can find that eight out of ten kids don't like a certain selection, you really don't have to go further; I know this isn't how test people work but it's unlikely that you're going to be too far off..."

"In high school American History, I think we got feedback from fifteen schools...[but]...teachers don't ask us how we know the books will work... I don't foresee any trend toward more field testing or evaluation. The 1970's will see, I feel, a

contest between the 'Silberman Camp' and 'performance contracts'...[Albert] Shanker made a good comment in the Times recently and I'll go along with his position. I don't understand what's going on in Washington these days...And I sure as hell would like to know what the hell the National Institute for Education is up to."

(This company has some field-test results available)

(Company D,Vice President and Editor-in-Chief)

"...mostly we depend on what we hear from people out in the field...Sure, field-testing is good, but it can be overdone...Some of the government-funded projects are needlessly complicated...They do their own material and revise it and revise it...Any good editor can do the same thing, just on the basis of his own experience...Holt's Biology still sells (this company is not Holt) after all the money they [the government] spent on the BSCS materials...We didn't test _____ or _____ and they're still among the best sellers we have."

(This company's field-test information is for its own use only. We were told that if a school wants information on field testing and the adoption is important enough, an appropriate editor will write a letter.)

In addition to this telephone survey, EPIE also conducted an analysis of advertisments for instructional materials that appeared in 13 issues of seven major educational journals and magazines in recent

months. In all, EPIE analyzed 344 advertisements. Only 17 contained references to any type of field-testing of the product being advertised. An EPIE researcher got in touch with the producers who had placed the advertisements. Only two of them referred our researcher to published research studies; six others said they would be willing to supply information which ranged from informal feedback from class trials to surveys of teacher comments. The producers responsible for the nine remaining advertisements were unable to refer us to (or send to us) any evidence to back up the statements made in their advertising.

In one case, it was quite evident that the producer had no data of any sort, even though his advertisement urged schools to get in touch with any regional office "to learn how well these materials are working in schools like yours" (This is not the exact wording of the advertisement.) A further investigation ascertained that when a school did, in fact, get in touch with a regional office it would first be sent a list of schools in that region

which had purchased the materials and then it would receive a visit from a salesman.

This sort of sales strategy is, of course, disturbing. However, in a sense it was even more disturbing to learn that during the months that this advertisement was being intensively run, the company received only five requests for their "field test" information from schools across the country! Sales, nonetheless, were quite satisfactory during the same period.

POINT 5.1

The way schools select materials does not encouage producers to create learner-verified materials

When one examines the ways in which most schools select materials this lack of attention to evidence of effectiveness resulting from learner-verification or field testing is not surprising.

EPIE learned this in 1969, when it cooperated with eight state education departments in surveying the evaluation practices used by schools and state agencies in the selection of instructional materials and equipment. The project identified and studied materials selection practices in 19 school systems designated by specialists across the country

as being more conscientious than many others in this task. In every case, these 19 schools relied almost completely on examination and review of the materials plus (in some cases) discussions with sales representatives. Only occasionally did selection committees use the results of student performance data from pilot tests of the materials conducted in local classrooms. Indeed, one state department of education included in the study strongly recommends local pilot testing of products, but we found little evidence that school systems in the state follow the suggestion.

A recent follow-up study of the 19 school systems indicates that the practices identified in 1969 are still in use today. However, we were somewhat encouraged by the fact that one of these systems does press producers for evidence of the learning effectiveness of their products, and that others sometimes seek such evidence. As yet none makes such evidence a purchasing specification.

POINT 5.2

Most schools fail to use learner-verification data when selecting materials

When one remembers that these 19 systems were designated as being more sophisticated than most others in the country in product selection, the nationwide picture remains pretty bleak. Nationally, we must still conclude that most schools fail to employ verification data from learners when selecting curriculum materials.

The reason for this, it would seem, is that in evaluating products school selection committees must devote most of their limited time to judging a product's content and pedagogical approach. Practically no time can be given to gathering evidence of a material's learning-effectiveness. Committees assume that materials with "good content and the right approach" will, by definition, be effective with learners. Logical as this may sound, it is not necessarily true.

POINT 5.3

Research supports use of learner-verification data as essential in product selection

Fortunately, some research exists which has examined the question of whether it is possible to infer the learning effectiveness of particular examples of instructional materials by simply examining them. This research raises serious doubts about the reliability of the practice of judging the quality of learning effectiveness without the help of learner-verification data.

In the first of such studies a group of teachers and a principal were asked to review and rank, for

effectiveness, alternate versions of a set of materials on which evidence of effectiveness with learners had been gathered by the researchers, but was not made available to the educators. With no evidence of effectiveness available to them, the educators were strikingly unsuccessful in judging the learning effectiveness of the materials they had attempted to rank. The correlation between their judgements and the actual performance of the materials with learners was -.75.

This study is one of few in the literature of educational research that has had its results corroborated by a second researcher with a similar group of subjects. Despite this fact, most school men and members of the education industry continue to put their faith solely in examination and review rather than evidence of actual performance when judging educational materials.

POINT 5.4

The real problem in schools and industry

Not just existing research, but common sense, makes it quite clear that at present any responsible effort to create or select materials of proven learning effectiveness must use data from learner-verification. So the problem is not that research does not answer the question directly and unambiguously -- the real problem is that the question of learning effectiveness does not seem to be of great interest to the producers and purchasers of educational materials. This situation is not the result of collusion or conscious negligence on the part of companies and schools, but rather of habit, apathy, and ignorance.

The fact of the matter is this: many producers and purchasers feel they <u>know</u> how to judge the learning effectiveness of materials. Thus, they become defensive when researchers suggest that their methods are less than reliable. Others, as we have seen, simply infer that materials examined and judged acceptable as to content and approach will also produce effective learning.

The problem, then, is one of changing well-established, comfortable behaviors on the part of both producers <u>and</u> purchasers. When such is the problem, it is difficult to change people by pointing to research studies. What, then, can be done to change present practices of product development and selection?

The first step is both simple and difficult. It is to admit honestly and candidly that these practices can and must be improved. What must be avoided at all costs is, on the one hand, preaching a counsel of perfection: "Research can't tell us precisely what to do, so let's not change things until it can" and, on the other hand, becoming defensive about established practices: "These practices have been

developed and refined through professional experience over the years.

POINT 5.5

A new credo for professionals in schools and in companies

The credo of all professionals -- in the education companies and in schools -- must be: "There isn't a product we produce, nor a product now in use, that cannot be improved. Every product must continuously be revised in light of the growing knowledge and the constantly changing needs of learners."

For example, most producers of materials for young children will eventually be forced to revise their products for youngsters who have been habitues of Sesame Street. This sort of shift in the learner's general knowledge base, brought about in large part by television, must continually be accounted for by producers of educational materials.

What is needed is a credo of improvement and accomplishment. In the few instances where this credo has been followed by action, the results indicate that some real progress has been made. Let me cite two examples of the sort of improvement and accomplishment that can be made when a product developer and product user admit that thing can be done differently.

TWO EXAMPLES OF VERIFIED MATERIAL

The first example I have chosen is a thoroughly researched product of a federally-sponsored regional educational laboratory. The second is a product

from the commercial textbook field that has been put through a reasonable approximation of learner-tryout over the last two decades.

The new product is the First Year Communications Skills Program developed by the Southwest Regional Laboratory for Educational Research and Development. The program has 10 units designed for use with kindergarten children. The units cover basic communications skills (e.g., naming the letters of the alphabet, reading simple selections). The program takes from 21 to 35 weeks for children to use, depending on the amount of time allocated daily. The producers state: "The reading skills to be acquired are listed very explicitly throughout the program and their successful mastery is the most important result of the instruction".

This language is similar in tone and content to the language one finds in the commercially-developed materials but the kind of evidence offered by the Southwest Laboratory in support of this statement is hardly, if ever, forthcoming from commercial developers.

The heart of the verification procedures used with these materials is a special kit that has been developed for "Quality Assurance". The contents in this kit are related to: (1) mid-year and end-of-the-year pupil performance, (2) information collection and reporting, (3) school-wide sampling plan and schedule, (4) data processing, (5) decision rules for selecting alternative courses of action, and (6) guidelines for evaluating program modifications.

Back-up data have been gathered over a four-year cycle of product development during which the units were continuously tried out with learners and accordingly revised. The developers readily admit that criterion mastery was not achieved when the product was first used with children. But now, after four years of continuous evaluation and revision, this mastery has been verified through use with more than 30,000 children in 12 states in middle sized schools and several large urban districts. These materials will eventually be commercially distributed.

The inclusion in the Southern Regional Laboratory's kit of a set of guidelines for evaluating program modifications prompts me to comment on a study which should be of particular interest to this Committee. It was recently brought to my attention by an educational researcher who discovered it in the process of preparing a review of research on the nature of product development. The study was conducted by the Department of Defense under the title of Project Hindsight.

POINT 6.1

D. D. study indicates that cost-effectiveness of technical systems are frequently improved thru a minor modification in one component or function

The relevant finding of Project Hindsight was that when researchers conducted a retrospective examination and analysis of the functioning of a technological system they were frequently able to identify a critical part or function that could be modified at very little cost. When the identified function was, in fact, modified as a result of this "hindsight" it was discovered that this low order modification of the single variable frequently resulted in very high order improvements in the overall effectiveness of the system.

In my opinion, it is not unlikely that the improvement of a critically important part of an educational material will bring about an improvement in the overall performance of the material comparable to the improvements achieved by Project Hindsight with technological systems.

My second example, a traditional enough looking textbook, was first published more than 20 years ago yet it continues to outsell all other texts in its field. It is an introduction to economics, created by Professor Paul Samuelson of M.I.T. as a freshman college text, which is also used in a few senior high school classes.

Since the first edition was published in 1948, seven subsequent editions have appeared and an eighth is scheduled. Each edition has gone through a three or four-year revision cycle in order to update content, organization and style of presentation--geared to increasing the effectiveness as well as the sales of the material.

To prepare for each revision, the developer gathers information from both teachers and students regarding the teaching-learning effectiveness and acceptability of the text. The author has informed EPIE that a sampling of institutions using the text is selected and questionnaires are distributed to students who have used it.

The questionnaires are returned directly to the author for analysis and use in revising the text. In addition to this tri-annual feedback from students the author continuously monitors the use of the materials with a small group of lower-than-average

students taught by another professor at a nearby university.

If the Committee wonders why I have selected this college text as my second example rather than one of the 14,000 elementary and secondary texts now on the market, it is because in four years of research EPIE has failed to identify one of those 14,000 texts which has been continuously and systematically revised over the years in a fashion comparable to that used by Professor Samuelson in revising his economics textbook.

POINT 6.2

All materials should be regularly revised using learner-verification data

From the standpoint of the relative size of the college and elementary-high school markets there is no reason why elementary and high school textbooks and other materials as well cannot be revised in this manner. There is also no reason why learner feedback at these lower educational levels could not involve actual measures of learning effectiveness obtained by testing students, whereas, at the college level, the use of student questionnaires requesting information about what they learned and failed to learn from the text is probably a justifiable alternative to such testing.

Today, there is a growing tendency within the education industry and the schools alike to play down textbooks in favor of more complex multimedia instructional systems. This movement is, in part, motivated by the belief that various effects which can be achieved by film, television, and sound and video tapes are educationally desirable (It is also true that media systems and kits often command higher prices and larger profit margins)

POINT 6.3

Effectiveness often sacrificed for new effects

The result is that schools often end up spending more money for a multiplicity of effects they may not need, but can easily buy, than for learner-effectiveness they cannot afford to do without. Research to date indicates that no one medium is always more effective than any other. This evidence has helped to produce the current trend toward using a multiplicity of media. However such multi-media systems may prove, in many cases to be a totally unnecessary brandishing of technology.

Buckminster Fuller characterizes the achievement of technology as "doing more with less." I suggest that--given the phenomenal growth and uncritical acceptance of all types of educational materials--

it just may be that we are "doing less with with more!" The kind of research and development being planned for the National Institute of Education could help us find out just what we are doing.

Without such systematic efforts we will continue to fly blind.

One example of such blind flying is in order. Recently a new multimedia course in elementary economics was developed for the U.S. Naval Academy by a private contractor. The course materials included programmed books, nonprogrammed printed materials, films, computer simulations and manuals, audio cassettes, and student response devices. Materials for each student cost approximately $100, not including the amortized cost of the films and computer simulations (The eleven simulation manuals cost an average of $3.50 each) Despite the availability of all these media, the majority of students opted for learning from the programmed books alone. Almost half said the films were boring and a waste of time. The programmed materials were learner-verified; the films were not.

The Naval Academy investment in this single course has been substantial ($643,020) and the continuing per student cost is by no means small. The Naval

Academy might well ask two questions: is the multiplicity of media really necessary or simply an example of technological overkill? How well do these course materials, costing approximately $100 per student, compare with Professor Samuelson's textbook costing a small fraction of that amount?

One thing is certain: We cannot afford the luxury of being encouraged by the two examples I have cited -- or by the few others I could have used. We must not forget that an estimated 99 percent of the materials now being sold to schools have not been developed in this fashion. The fact to remember is that the 200,000-plus educational materials represented by that 99 percent will not suddenly disappear from schools, nor will they be taken off the market by their producers. Many of these materials are far from worthless, but all of them are far from being as good as they could be -- indeed, must be -- if they are to meet education's new needs. If, for instance, they were designed with no "target learners" in mind then there is an urgent need to discover with which learners they are most effective -- and on which

learners they are lost. These are persistent, unanswered questions that must be dealt with, if the ultimated educational consumer -- the learner- is to be served. Schools must have materials that meet the needs of all our children -- and that meet them as individually as possible.

POINT 6.4

Yesterday's tools are not good enough

As they now stand, the materials schools use are not good enough to meet this need, nor are they good enough to expect our teachers willingly to to be held accountable for what students fail to learn when required to use those materials. Schools give students and teachers yesterday's tools and expect them to prepare our society for tomorrow. If the response of both is increasing unrest, should we be surprised? The time to retool education is now -- before a revived economy and a less cautious Congress make educational money once again easy to come by.

Unless action is taken now, schools will inevitably spend the money they receive for what is available, in other words for the unimproved materials they are now using. What specifically should be done?

RECOMMENDATIONS

POINT 7.1

Need for National Institute

First, a National Institute of Education is needed to institutionalize a continuing broad-based research program into the many problems surrounding the development, evaluation, selection and use of educational products. This program should place great emphasis on the need to improve materials-via learner-verificatior It also must try to discover other means of improving the effectiveness of educational materials.

Had a National Institute of Education with such a charge been established as part of the National Defense Education Act in 1958 or as part of the Elementary and Secondary Education Act in 1964, there would be no need for me to be here. But time, money and learning are being wasted. We must improve the tools which 50 million learners and two million teachers are required to use.

POINT 7.2

Need for realistic guidelines for producers and schools

The first task of the National Institute of Education in such a program should be the development and dissemination of realistic guidelines to help product developers institute a program of verification and revision. These guidelines would be aimed at both commercial and non-commercial product developers.

A second set of guidelines should also be developed to assist the schools in selecting materials. Here too, great emphasis would be put on guiding schools to the purchase of learner-verification materials only These guidelines would not eliminate the need for independent product evaluations, but they could help create a set of minimum standards to be used by independent product evaluators.

I repeat that these guidelines must be realistic; I mean that they must contain realistic recommendations and make realistic demands. The guidelines put forth for the development and selection of programmed instruction materials in 1963 by a joint committee of three well-meaning professional associations were not realistic. Those guidelines mistakenly counseled perfection and advocated a single route to that perfection. Needless to say, the guidelines had little effect.

Educational producers, educational practitioners, and for that matter, educational researchers are not perfect--but they all can improve. Thus, the guidelines envisioned here are guidelines that would be implementable by any producer or any school wishing to improve present practice. And they would be realistic enough to offer a number of routes to achieving improvement, i.e., modest products could be evaluated modestly, and more complex and more expensive products more ambitiously. Products such as total reading programs or entire K-12 curriculum programs would receive thorough, continuous learner verification on a even larger scale, with great attention to the task of adapting these major programs to the changing needs of learners.

The specific mechanism for formulating these guidelines would be an NIE Technical Task Force made up of NIE staff and representative groups of specialists in product verification. Such specialists employed in the education industry should be invited to participate as individuals.

The working assumption of this Task Force should be that all educational materials (with the exception of those not designed for the teaching and learning of specific instructional objective, i.e., fiction, biographies, general background or enrichment materials in book or nonbook media) should be continuously revised using data from learner-verification.

The guidelines for schools should help purchasers make maximum and efficient use of verification evidence, and should urge schools to refuse to purchase non-verified materials.

If this NIE Task Force cannot be formed under the aegis of NIE this year, then an interim task force should be formed which could work under NIE when it becomes established. EPIE would be happy to serve as a vehicle for this task force.

Once these guidelines have been developed and disseminated, producers would be expected to comply with them within a specified period of time. At the end of that period, each producer would be expected to publish a statement of learner-verification evidence for each of his products.

Obviously, it is going to cost producers money as well as time to comply with the proposed guidelines. Producers will have a new item to add to their product development budgets: the cost of gathering and using feedback from learners. Sad to say, this will be a totally new experience for most producers. This increased cost must inevitably increase the costs of materials to schools. But continuously improved learner-verified materials must in the long run reduce many important non-dollar costs that are now being passed on to the learner.

POINT 7.3

Federal aid for the support of learner-verified materials

If these increased dollar costs are too great for producers and purchasers to absorb, then federal aid might be offered. Federal aid to producers could take the form of research and development grants to be used to improve specific materials through verification and revision. Federal

aid to schools could be in the form of increased Federal funds for school systems that use the proposed guidelines and institute purchasing policies that clearly demand learner verified materials. The outcome of such strategically-managed Federal funding would be to drive out stagnant, unimproved materials and provide schools with useful and effective alternatives to what they are now using.

But until such a system is instituted, schools should do two things: press producers to supply evidence of the learning effectiveness of their materials, and indicate their willingness to serve as sites for learner-verification studies.

POINT 7.4

Education companies and school boards share the responsibility for continued use of unimproved materials

Until such time as these recommendations, or a reasonable facsimile of them are adopted, educational companies that fail to conduct evaluations during the development and revision of a product and school boards that fail to demand proof of such evaluations share the responsibility for putting unproven learning materials into the hands of teachers and students.

I repeat my contention that this situation is the result more of habit, apathy, and ignorance than of collusion or negligence on the part of companies and schools, but I also state that now is the time to change the habits that have created the present situation. All parties, the industry, the schools, and the Congress must admit to having been ignorant; now they must do what must be done to become wiser. The proposed National Institute could do much to create the knowledge upon which such wisdom depends. Millions of children stand to learn better if we will allow ourselves to create that knowledge and seek that wisdom.

I realize I have said a great deal in this testimony about the need for learner-verification and revision as a means of improving educational materials, and as a means of protecting the learner as the ultimate educational consumer. In closing, I want to make it clear that I have placed this emphasis on learner-verification not because I see it as the only means of improving the effectiveness of educational materials, but because at present it is a thoroughly effective means of improvement at the disposal of both producers and schools -- which is largely ignored.